

CLAIMS

- 1 1. A circuit comprising:
 - 2 a sensor having at least one output port at which a first signal voltage is provided in
 - 3 response to the presence of a magnetic field of a first polarity and at which a second signal
 - 4 voltage is provided in response to the presence of magnetic field of a second polarity; and
 - 5 a detector having at least one input port coupled to the at least one output port of the
 - 6 sensor and an output port at which an output signal is provided, the output signal being
 - 7 indicative of the presence of said magnetic field of said first polarity and the presence of said
 - 8 magnetic field of said second polarity.
- 1 2. The circuit of claim 1 wherein said sensor is a Hall element.
- 1 3. The circuit of claim 1 wherein said magnetic field is provided by an article and said
2 detector output signal is indicative of the article being positioned within a predetermined
3 distance of said sensor.
- 1 4. The circuit of claim 1 wherein said detector is a comparator.
- 1 5. A switching system for providing a signal in response to an article which provides a
2 magnetic field, the switching system comprising:
 - 3 (a) a sensor for sensing the magnetic field of the magnetic article, said sensor for
4 generating a first signal voltage having a signal voltage level which is proportional to a
5 magnetic field having a first polarity and a second signal voltage having a signal voltage level
6 that is proportional to a magnetic field having a second different polarity; and
 - 7 (b) a threshold detection circuit coupled to the sensor to receive the first and second signal
8 voltages and to provide an output signal having a first value when said magnetic article is
9 within a predetermined distance of the sensor regardless of the polarity of the magnetic field.
- 1 6. The switching system of Claim 5 wherein:

2 said sensor is a magnetic-field-to-voltage transducer for generating a first signal
3 voltage having a signal voltage level which is proportional to a magnetic field having a first
4 polarity and a second signal voltage having a signal voltage level that is proportional to a
5 magnetic field having a second different polarity; and

6 said threshold detection circuit is coupled to said magnetic-field-to-voltage transducer
7 to receive the first and second signal voltages and to provide an output signal having a first
8 value when the article is within the predetermined distance of said magnetic-field-to-voltage
9 transducer regardless of the polarity of the magnetic field with respect to said magnetic-field-
10 to-voltage transducer.

1 7. The switching system of Claim 6 wherein:
2 said magnetic-field-to-voltage transducer is a Hall element circuit; and
3 said threshold detection circuit is a comparator coupled to said Hall element circuit.

1 8. The switching system of Claim 7 wherein said comparator is a window comparator
2 comprising first and second differential pair circuits, each of said first and second differential
3 pair circuits having an input terminal coupled to one of a pair of outputs from said Hall
4 element circuit and an output terminal coupled to an output terminal of said comparator.

1 9. The switching system of Claim 8 further comprising a filter and level shifter circuit
2 coupled between said Hall element circuit and said comparator.

1 10. The switching system of Claim 8 further comprising first and second output amplifier
2 stages, each of the output amplifier stages coupled between a respective one of the output
3 terminals of the first and second differential pair circuits and the output terminal of said
4 comparator.

1 11. The switching system of Claim 10 further comprising an output/buffer amplifier stage
2 having an input terminal coupled to the output terminal of each of said first and second output
3 amplifier stages and having an output terminal coupled to the output terminal of said
4 comparator.

1 12. The switching system of Claim 5 further comprising a temperature and voltage bias
2 circuit coupled to said comparator, said temperature and voltage bias circuit for maintaining
3 operating signals in said threshold detection circuit within a predetermined range of operating
4 signal levels in response to changes in supply voltage and operating temperature.

1 13. A cellular telephone comprising:
2 a base;
3 a cover having a first end movably coupled to said base and a second end;
4 a magnetic article disposed in the second end of said cover, said magnetic article
5 having a first pole and a second pole; and
6 a switch disposed in said base, said switch comprising:
7 a sensor for sensing the magnetic field of the magnetic article, said sensor for
8 generating a first signal voltage having a signal voltage level which is proportional to a
9 magnetic field having a first polarity and a second opposite signal voltage having an
10 opposite signal voltage level that is proportional to a magnetic field having a second
11 different polarity; and
12 a comparator coupled to the sensor to receive the first and second signal
13 voltages and to provide an output signal having a first value when said magnetic article
14 is within a predetermined distance of the sensor regardless of the polarity of the
15 magnetic field.

1 14. The cellular telephone of Claim 13 further comprising a control circuit coupled to said
2 switch.

1 15. The cellular telephone of Claim 13 wherein said sensor is provided as a magnetic-field-
2 to-voltage transducer which generates at output terminals a first signal voltage having a first
3 signal level voltage which is proportional to a magnetic field having a first polarity and a
4 second signal voltage having a second signal voltage level that is proportional to a magnetic
5 field having a second different polarity.

1 16. The cellular telephone of Claim 15 wherein:

2 said sensor includes a Hall element; and
3 said comparator is a window comparator.

1 17. The cellular telephone of Claim 16 wherein said comparator receives signals from said
2 Hall element and provides an output signal having a first value when said magnetic article is
3 within the predetermined distance of said Hall element regardless of the polarity of said
4 magnetic article with respect to said Hall element and provides an output signal having a
5 second different value when said magnetic article is not within the predetermined distance of
6 said Hall element regardless of the polarity of said magnetic article with respect to said Hall
7 element.

1 18. The cellular telephone of Claim 17 said comparator comprises:
2 a first comparator having a first input terminal adapted to receive a first threshold
3 voltage, a second input terminal adapted to receive an input voltage from said Hall element,
4 and an output terminal coupled to an output terminal of said switch; and
5 a second comparator having a first input terminal adapted to receive the input voltage,
6 a second input terminal, adapted to receive a second threshold voltage and an output terminal
7 coupled to an output terminal of said switch.

1 19. The cellular telephone of Claim 18 wherein said first and second comparators are each
2 provided having a means for including hysteresis.

1 20. The cellular telephone of Claim 18 wherein said switch further comprises means for
2 changing a switch point of said first and second comparators.

1 21. A method of switching comprising the steps of:
2 (a) sensing a magnetic field provided by a magnetic article having a first pole and a second
3 pole wherein said magnetic article has first magnetic field polarity at the first pole and a
4 second different magnetic field polarity at the second pole;
5 (b) generating a sensor output signal having a signal level which is proportional to the
6 magnetic field sensed in step (a), wherein the sensor output signal has a first signal direction

7 when the sensed magnetic field has the first polarity and a second opposite signal direction
8 when the sensed magnetic field has the second different polarity;
9 (c) comparing the sensor output signal to one of first and second threshold signal levels;
10 and
11 (d) in response to the sensor output signal level reaching or exceeding the one of the first
12 and second threshold signal levels, providing an output signal having a first signal level
13 regardless of the direction of the sensor output signal.

1 22. The method of Claim 21 further comprising the step of:
2 (e) in response to the sensor output signal having a first signal level which is less than the
3 one of the first and second threshold signal levels, providing an output signal having a second
4 different signal level regardless of the direction of the sensor output signal.

1 23. The method of Claim 22 wherein, in response to the output signal changing from the
2 first signal level to the second different signal level the method further comprises the steps of
3 changing a switch point of a threshold circuit from a first predetermined threshold level to a
4 second predetermined threshold level.

1 24. The method of Claim 23 wherein the absolute value of the first predetermined
2 threshold level is greater than the absolute value of the second predetermined threshold level.